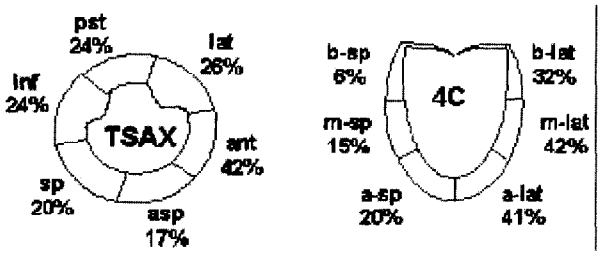
(21%), anteroseptal (0%) and anterior (14%) segments. **Conclusion:** Use of HI with TEE improves endocardial visualization and allows partial assessment of myocardial perfusion, which may prove beneficial in the intraoperative setting.



1188-33 **Left Ventricular False Tendons: Echocardiographic Curiosity or Clinically Relevant?**

Satish Kenchaiah, Emelia J. Benjamin, Jane C. Evans, Daniel Levy, Ramachandran S. Vasan, Framingham Heart Study, Framingham, MA, Boston University School of Medicine, Boston, MA

Background: Although Left ventricular false tendons (LVFT) are generally considered as normal anatomic variants, they have been associated with innocent precordial murmurs, ventricular arrhythmias, and repolarization abnormalities in small case series. The correlates of LVFT in the community are unknown.
Methods: We examined the cross-sectional clinical, electrocardiographic (ECG), and echocardiographic (echo) correlates of LVFT in 101 subjects with LVFT (mean age 56, 45% women) and 151 subjects without LVFT (mean age 57, 44% women) in the Framingham Heart Study.
Results: After adjusting for age and sex, LVFT were associated with innocent precordial murmurs, ECG LV hypertrophy, and echo LV systolic dysfunction **(Table)**. Body mass index was inversely related to the presence of LVFT. The relations between LVFT and precordial murmurs or ECG LV hypertrophy remained unchanged after further adjustment for body mass index. LVFT were not associated with hypertension, ECG ventricular premature beats or repolarization abnormalities, and echo LV mass, wall thickness, or diameter.
Conclusions: In our community-based sample, LVFT were observed more commonly in lean subjects, likely due to better visualization. Our study confirms the association of LVFT with precordial murmurs, and identifies ECG LV hypertrophy and LV systolic dysfunction as additional correlates not reported in prior literature.

LVFT and Correlates

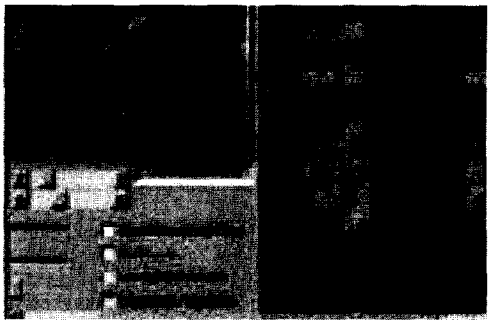
Characteristic	LVFT present (n=101)	LVFT absent (n=151)	p-value *
Body mass index (kg/m2), means±SD	25.3±5.0	27.0±5.2	0.0099
Innocent precordial murmurs (%)	10	2	0.0013
Ventricular premature beats on 10-second ECG rhythm strip (%)	4	2	0.33
ECG-LV hypertrophy (%)	9	2	0.014
LV ejection fraction <50% (%)	10	4	0.049

*Adjusted for age and sex

1188-34 **Assessment of the Extent of Ischemic Aneurysm as Defined by Curved M-Mode Analysis of Regional Strain Rate: An In Vivo Study in a Chronic Animal Model**

Julia C. Swanson, Sebastian T. Schindera, Michael Jones, Crispin H. Davies, Rosemary A. Rusk, David J. Sahn, Oregon Health & Science University, Portland, OR, National Heart, Lung & Blood Institute, Bethesda, MD

Background: Strain rate imaging (SRI) appears to be sensitive to regional dysfunction in ischemic disease because it discriminates intertarget deformation from tethered passive motion or cardiac motion. **Methods:** We studied 8 sheep (30-47kg) 8-10 weeks after LAD or diagonal occlusion was performed to produce a chronic ischemic aneurysm. Two-D TDI/SRI images were recorded using a GE/VingMed Vivid FIVe system. After study over 4 stages (baseline, metoprolol, dobutamine and transfusion of blood), the animals' hearts were arrested and removed for pathologic study. Digital TVI SRI loops were measured on a custom version of Echopac® that allows derivation of curved M-modes displaying SRI color codes of yellow to red for compression, blue for expansion and green for no deformation. The arc lengths were measured and compared to the endocardial infarct zone area as a percent of total endocardial area at postmortem. **Results:** Infarct/aneurysm area ranged from 15-33%, mean 21.3 ± 6.1(SD) and no-deformation zone length as a measure of endocardial length in the 2-chamber view ranged from 7-26%, mean 17.3 ± 4.2. The best correlation between infarct area and no-deformation arc length in systole was r = 0.84, p < 0.05, for the baseline stage.



POSTER SESSION

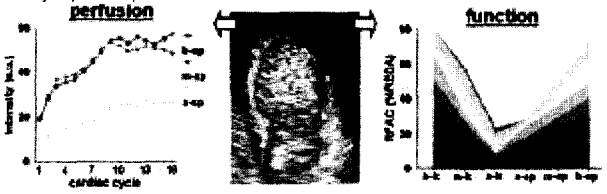
1189 New Echocardiographic Methods for Assessing Ventricular Function

Tuesday, April 01, 2003, Noon-2:00 p.m.
McCormick Place, Hall A
Presentation Hour: 1:00 p.m.-2:00 p.m.

1189-35 **Automated Simultaneous Echocardiographic Quantification of Myocardial Perfusion and Regional Left Ventricular Function in Patients Post Myocardial Infarction**

Victor Mor-Avi, Jeanne M. DeCara, James E. Bednarz, Lynn Weinert, Keith A. Collins, Enrico G. Caiani, Roberto M. Lang, University of Chicago, Chicago, IL

We tested the feasibility of an automated technique for objective, simultaneous assessment of myocardial perfusion and LV function in humans. **Methods.** We studied 8 patients within 24h of primary PTCA after proximal LAD myocardial infarction (MI). Power modulation (PM) images were obtained during iv infusion of Definity with prototype color-encoding of endocardial motion (Philips). Color information was used to obtain regional fractional area changes and automatically define myocardial regions of interest. Regional end-systolic PM intensity was measured over time to calculate post-impulse steady-state contrast level and replenishment rate. An expert reader reviewed gray-scale images for visible perfusion defects and wall motion abnormalities. **Results.** 6/8 patients had perfusion defects accompanied by regional wall motion abnormalities: 4 showed no perfusion and 2 had "patchy" myocardial contrast. The remaining 2 patients showed delayed contrast replenishment with normal wall motion. Contrast level and replenishment rate were 61% and 51% lower in segments where perfusion defects were noted. In all patients with wall motion abnormalities, thin color bands were noted in hypokinetic segments, resulting in a 58% decrease in fractional area change. **Conclusions.** Contrast-enhanced, color-encoded PM images allow simultaneous, real-time imaging and quantitative analysis of myocardial perfusion and regional LV function, which may be useful to predict functional recovery in patients post MI.

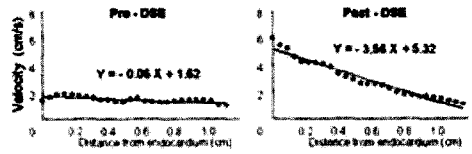


1189-36 **Quantitative Assessment of Left Ventricular Myocardial Viability During Low Dose Dobutamine Stress Echocardiography in Combination With Color Tissue Doppler Imaging**

Hideji Tanaka, Tomotsugu Tabata, Eriko Kimura, Kenji Harada, Tetsuzo Wakatsuki, Takashi Yamamoto, Akihiro Saito, Kozo Uehara, Norihito Kageyama, Takashi Oki, The University of Tokushima, Tokushima, Japan, The National Higashi - Tokushima Hospital, Tokushima, Japan

Background: Myocardial viability in patients with myocardial infarction has been assessed by low dose dobutamine stress echocardiography (DSE). Color tissue Doppler imaging (TDI) can optimize myocardial velocity profile (MVP) from endocardium to epicardium. Non-isotropic averaging algorithm (PowerView, Toshiba Corp., Japan) was newly developed for obtaining stable MVP.
Purpose: To quantitatively detect viable myocardial region using MVP during low dose DSE.
Methods: Subjects consisted of 12 patients with previous myocardial infarction with myocardial contraction abnormality scintigraphically (99mTc-MIBI) expected to have viable myocardium. Dobutamine was administered incrementaly by 10 minutes interval (1, 3, 5, 10, μg/kg/min). Color TDI in parasternal short-axis view was recorded during DSE

and MVP was analyzed off-line.
Results : 1) Wall motion score index (WMSI) assessed by 2DE decreased significantly in 9 of 12 patients (75%) reflecting improvement of regional wall motion abnormality. 2) In contrast, in 11 of 12 patients (92%) the peak systolic myocardial velocity (1.17 vs 4.97cm/s, $p < 0.001$) and transmyocardial velocity gradient (0.06 vs 3.26 s^{-1}, $p < 0.001$) obtained by MVP at the region suspected to be viable increased significantly.
Conclusions: Myocardial velocity profile (MVP) obtained from color TDI during low dose DSE quantitatively assessed myocardial viability in patients with myocardial infarction. MVP was better sensitive than evaluation using conventional WMSI.



slope of the regression line = myocardial velocity gradient

1189-37 Tissue Doppler Imaging Pattern of Left Bundle Branch Block Is a Strong Predictor for Mortality in Patients With Heart Failure

Rachele Adorisio, Cristina M. Volponi, Massimo Mancone, Chiara Bucciarelli, Leonardo De Luca, Salvatore Musarò, Francesco Fedele, Università La Sapienza Dip Scienza Cardiovascolari e Respiratorie, Roma, Italy

Background Recent studies had established that left bundle branch block (LBBB) is a strong predictor for mortality in patients with heart failure (HF). Aim of the study was to assess if different electromechanical pattern due to LBBB, established by Tissue Doppler Imaging, had an influence on mortality in patients with HF. **Methods** We studied 21 patients with LBBB and dilated cardiomyopathy with 2D echocardiography and Tissue Doppler Imaging (TDI). We analyzed qualitatively color coded M-mode of interventricular septum (IVS) and the following electromechanical patterns were identified: mildly unsyncronized *(IIA)*, severely unsyncronized *(IIB)*, reversed early in systole *(IIIA)* reversed late in systole *(IIIB)*, reversed throughtout all the systole *(IV)*. All patients were divided in three groups, according to left ventricular function (LVEF): *Group I*: <30% LVEF; *Group II*: 30-40% ; *Group III*: >40%. We considered also age, NYHA functional class, QRS narrowing and mitral regurgitation for multivariate analysis. **Results** The highest mortality rate (100%) was observed in IIIB electrical-mechanical pattern and LVEF 30-40%, while the lowest mortality rate (25%) was related to IIA TDI pattern with LVEF <30% (100% vs 25%, $p< 0.01$). The multivariate analysis show that the electromechanical pattern is a strong predictor for mortality *indipendently* from age, NYHA functional class, QRS narrowing, mitral regurgitation ($\chi^2= 0$; df=1). **Conclusions** TDI is an useful method to assess the severity of LV asincrony. The electromechanical pattern is a strong predictor on mortality, indipendently from LVEF, in HF patients.

1189-38 Longitudinal Myocardial Displacement and Strain Rate in the Hypertrophied Heart Evaluated by Tissue Strain Imaging With Doppler Angle Correction and Tissue Tracking Technique

Tomotsugu Tabata, Hideji Tanaka, Eriko Kimura, Kenji Harada, Tetsuzo Wakatsuki, Takashi Yamamoto, Akihiro Saito, Kozo Uehara, Norihito Kageyama, Hirotsugu Yamada, Takashi Oki, The University of Tokushima, Tokushima, Japan, The National Higashi-Tokushima Hospital, Tokushima, Japan

Background: The left ventricular (LV) systolic function in the long-axis direction has been evaluated by pulsed tissue Doppler mitral annular motion velocity. However, it could not avoid the effect of cardiac translation. A prototype software (ApliQ, Toshiba Corp.) was recently developed to obtain tissue strain imaging (TSI). In this program, the center of contraction was set in the LV cavity and velocity was automatically angle-corrected. The velocity values from the same region of moving myocardium were automatically defined and interrogated over time to yield displacement by 2D tissue Doppler tracking technique. TSI was finally obtained as a spatial derivative of the tissue displacement. **Purpose**: To evaluate longitudinal LV myocardial contractile characteristics in hypertrophied heart using TSI. **Methods**: Subjects consisted of 20 normal (N), 20 hypertensive hypertrophy (HHD) and 12 asymmetric septal hypertrophy (ASH). Color tissue Doppler image was recorded from apical four chamber view and the TSI at the base of ventricular septum was analyzed off-line. **Results**: Peak systolic displacement (Dp) and peak systolic strain rate (SRp) decreased and time to Dp prolonged in hypertrophied heart (table). **Conclusions**: Longitudinal myocardial fiber contraction was depressed in hypertrophied ventricular septum especially in asymmetric hypertrophy. TSI with Doppler angle correction and tissue tracking can quantitatively evaluate longitudinal LV contractility regardless of cardiac translation.

	Dp (cm)	Time to Dp (msec)	SRp (1/s)
N	10.4 +/- 3.2	267 +/- 60	16.1 +/- 3.0
HHD	8.7 +/- 2.8	303 +/- 54*	11.2 +/- 3.7*
ASH	5.7 +/- 1.0*#	338 +/- 46*	8.6 +/- 2.0*#

1189-39 Accurate and Quick Assessment of Left Ventricular Function in Patients With Ischemic Heart Disease Using Biplane Advanced Automated Contour Tracking Method

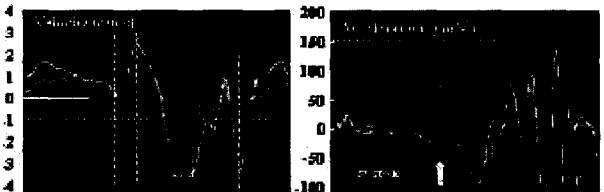
Kenichi Sugioka, Takeshi Hozumi, Hiroyuki Watanabe, Yoshiki Matsumura, Yasuhiko Takemoto, Hiroyuki Yamagishi, Takashi Muro, Minoru Yoshiyama, Kazuhide Takeuchi, Junichi Yoshikawa, Osaka City University, Osaka, Japan

Background: Newly developed, advanced automated contour tracking (AACT) method allows accurate automated detection of the left ventricular (LV) endocardial boundary of echocardiographic apical images by just placing 3 sample points at both sides of the mitral annulus and the LV apex. Accurate LV ejection fraction (EF) may be estimated by applying the AACT method to two orthogonal planes in patients with ischemic heart disease (IHD) even with regional wall motion abnormalities. The purpose of this study was to examine the reliability of the biplane AACT method in the measurement of LVEF in patients with IHD by using quantitative gated SPECT (QGS) as a reference standard.
Method: The study population was consisted of 46 consecutive patients who underwent QGS. In every patient, both apical 4- and 2-chamber views were obtained by 2-dimensional echocardiography. Biplane LVEF was measured off-line by both AACT method and manual tracing method using modified Simpson's method. The accuracy of the AACT method for LVEF measurement was determined in comparison to QGS. The reproducibility of the AACT method for LVEF measurement was assessed by two blinded observers and compared to that of manual tracing methods.
Results: In 40 patients (24 with and 16 without regional wall motion abnormalities) of 46 patients (87.0%), adequate images were obtained for LVEF analysis. LVEF measured by the AACT method was correlated well with that by QGS ($y=0.94x+3.7$, $r =0.91$). The mean difference between AACT and QGS was 0.4±5.5% (mean±SD). The mean time required for analyzing one set of image by the AACT method was much shorter than that by manual tracing method (7±1 vs. 37±4 sec, $p<0.0001$). The observer variabilities for LVEF assessment were also significantly smaller in the AACT method compared to manual tracing method (intraobserver variability; 4.5±3.3 vs. 8.8±6.0 %, $p<0.005$, interobserver variability 8.5±6.8 vs. 13.7±8.4 %, $p<0.05$).
Conclusion: The biplane AACT method provides accurate and quick measurement of LVEF in patients with IHD.

1189-40 Quantitative Assessment of Regional Peak Myocardial Acceleration During Isovolumic Contraction and Relaxation Time by Tissue Doppler Imaging

Ikuo Hashimoto, Xiaokui Li, Brent J. Barber, Aarti Heimadi, Michael Jones, David J. Sahn, Oregon Health & Science University, Portland, OR, National Heart, Lung, and Blood Institute, Bethesda, MD

Background: Myocardial acceleration during isovolumic contraction (ICT) has been reported as an index of contractility. **Methods:** We studied 8 sheep using tissue Doppler imaging (VingMed Vivid FiVe) in apical 4-chamber views to evaluate 6 left ventricular wall segments and 2 mitral annulus sites. We analyzed peak myocardial acceleration during isovolumic periods (pIVA) derived from tissue Doppler imaging during ICT and isovolumic relaxation (IRT) for each segment. After scanning for the baseline, we changed hemodynamic status by blood, dobutamine and metoprolol infusion and compared the pIVA during IRT and ICT under 4 different hemodynamic conditions and peak positive and negative dP/dt conditions. **Results:** pIVA of basal lateral segment during ICT showed the strongest correlation with peak positive dP/dt ($r = 0.96$, $p<0.0001$) and there was good correlation between pIVA of septal mitral valve annulus during IRT with peak negative dP/dt ($r = 0.80$, $P < 0.0001$). There was a significant difference in pIVA between dobutamine and metoprolol conditions during ICT in all segments ($p < 0.05$), but pIVA was less sensitive to blood loading. pIVA during IRT showed little difference between the 4 different hemodynamic conditions. **Conclusions:** pIVA during ICT is a sensitive, preload independent marker for evaluation of dP/dt; the pIVA of basal lateral wall during ICT showing the strongest correlation with peak positive dP/dt; pIVA of septal mitral valve annulus during IRT showed a good correlation with peak negative dP/dt.



1189-41 True 2-D Velocity Display by Multiscale Motion Mapping (Triple-M Imaging) Allows New Insights Into Complex Cardiac Motion Patterns

Christian H. Jansen, Michael Sühling, Muthuvel Arigovindan, Stephan Marsch, Michael Unser, Patrick Hunziker, University Hospital of Basel, Basel, Switzerland, Swiss Federal Institute of Technology, Lausanne, Switzerland

Background: Quantitative motion assessment in echo usually relies on tissue Doppler & border detection algorithms despite known limitations. **Methods:**
Multiscale motion Mapping is a novel image processing technique combining optical flow & spline imaging in space & time. Using all available grayscale info, it yields quantitative